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DATA SHEET

TEA1501
Greeny; GreenChip™

Preliminary specification
File under Integrated Circuits, IC11

1998 Aug 19

Philips Components

PHILIPS

Greeny; GreenChip™ TEA1501

FEATURES

- Direct off-line operation (90 to 276 V AC)
- Low external component count
- Integrated high voltage startup current source for a fast startup within 0.25 s
- Integrated power switch: 650 V, 40 Ω, 0.25 A
- Programmable primary peak current
- Data transfer from isolated secondary side to non-isolated primary side via the transformer
- On/Off function replaces expensive mains switch by a functional switch.

Green features

- Low current consumption in Off mode, typical 40 μA
- Efficient burst mode operation, for 0.1 to 3 W output power.

Protection features

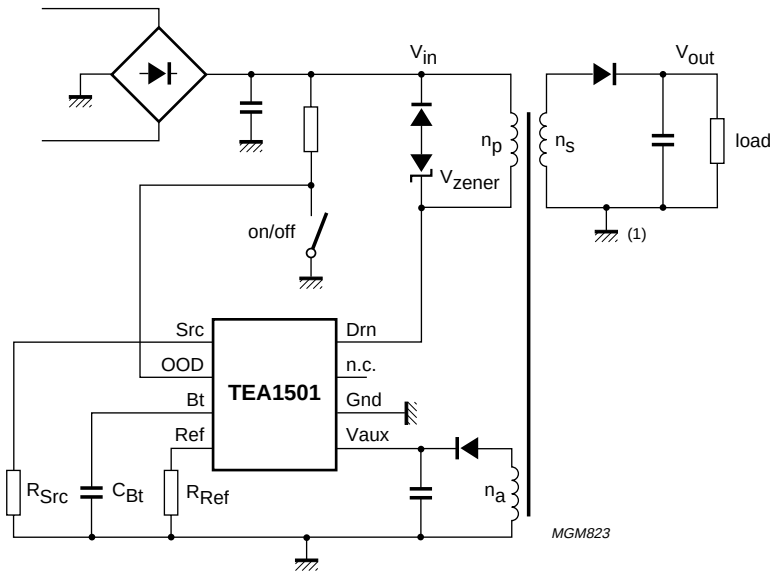
- Cycle-by-cycle current control with programmable primary peak current
- Over-voltage protection
- Under-voltage lockout
- Over-temperature protection.

GENERAL DESCRIPTION

The TEA1501 (Greeny) is the low power member of the GreenChip™ family and is especially designed for standby switched mode power supply applications. Greeny incorporates all the necessary functions for an efficient and low cost power supply for 90 to 276 V AC universal input. Greeny is a monolithic integrated circuit and is available in a DIP8 package. The design is made in the BCD_PowerLogic750 process and includes the high voltage switching device. Using only 7 functional pins, Greeny contains extensive control functions to form a flexible and a reliable power supply with a minimum of external components. Greeny operates in a flyback topology (see Fig.1) with a fixed switching frequency, constant primary peak current control and regulates the output voltage in burst mode.

Applications include low power supplies and standby power supplies as used in television, monitor, lighting electronics and domestic appliances with an output power from 0.1 to 3 W.

BASIC FLYBACK CONFIGURATION



(1) The secondary earthing point is isolated from the primary earthing points.

Fig.1 Basic flyback configuration.

QUICK REFERENCE

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{on/off}$	on/off level Greeny		0.4	0.7	0.9	V
$V_{data(off)}$	data off level	20 μA < I_{OOD} < 100 μA	0.9	1.3	1.6	V
$V_{data(on)}$	data on level	20 μA < I_{OOD} < 100 μA	3.5	4.0	4.5	V
I_{start}	startup current, Vaux pin	V_{Vaux} = 8 V, V_{OOD} > 0.9 V	–2.4	–1.8	–1.2	mA
$I_{Drn(off)}$	drain current in Off mode	V_{OOD} < 0.4 V	–	40	100	μA
V_{BD}	breakdown voltage	$I_{Drn(off)}$ + 100 μA	650	–	–	V
R_{dson}	on resistance	T_j = 25 °C, I_{Drn} = 80 mA	25	40	55	Ω
V_{detect}	detection level		0.47	0.50	0.53	V

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TEA1501	DIP8	plastic dual in-line package; 8 leads (300 mil)	SOT97-1

BLOCK DIAGRAM

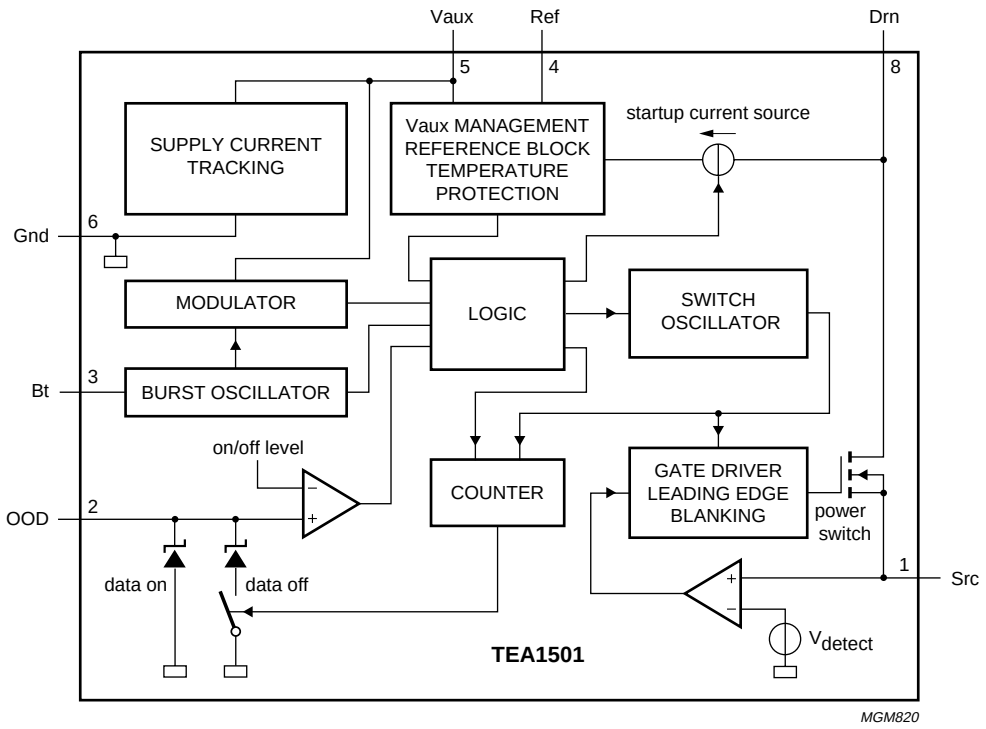


Fig.2 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
Src	1	source of the power switch and input for primary current sensing
OOD	2	on/off input and data transfer output
Bt	3	input for burst capacitor
Ref	4	input for reference resistor
Vaux	5	supply input of the IC and input for voltage regulation
Gnd	6	ground
n.c.	7	not connected to comply with safety requirements
Drn	8	drain of the power switch and input for startup current

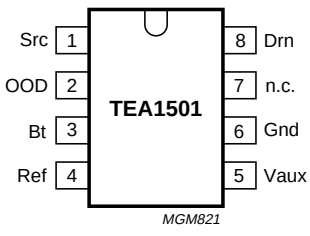


Fig.3 DIL8 Package.

FUNCTIONAL DESCRIPTION

The TEA1501 contains a high voltage power switch, a high voltage startup circuit and low voltage control circuitry on the same IC. Together with a transformer and a few external components a low power, isolated, flyback converter can be built. The Greeny system operates in a burst mode. During each burst period the output voltage is regulated to a desired voltage level.

System operation

ON/OFF

The Greeny system can be switched on and off by means of a low cost, low voltage switch. In the Off mode the startup current source and power switch are disabled. In the On mode, Greeny delivers the startup current for the supply capacitor and after the supply voltage reaches the startup level Greeny activates the power switch.

STARTUP

The startup is realized with a high voltage startup current source instead of a dissipative bleeder resistor which is commonly used by low voltage control ICs. When Greeny is switched on, the startup current source is enabled and starts charging the Vaux capacitor. The startup current level is high and accurate (typical 1.8 mA) which results in a well-defined and short startup time, within 0.25 s. After the supply voltage reaches the startup level the current source is switched off and the Vaux capacitor supplies the chip. Reducing the power dissipation in the current source to zero after startup is one of the green features of Greeny.

OPERATION

After startup the flyback converter starts delivering energy to the secondary and auxiliary winding. The Greeny system works with fixed switching frequency and fixed peak current.

As all the windings of the flyback transformer have the same flux variation, the secondary voltage and the auxiliary voltage are related via the turns-ratio (n_s/n_a). Therefore, the isolated secondary voltage is controlled by the non-isolated auxiliary voltage.

The burst mode operates by switching at high frequency until the Vaux voltage reaches its regulation level of 20 V. Greeny stops switching until the time period set by the burst oscillator has expired. At the start of the next burst period Greeny starts switching at high frequency and repeats the cycle again.

To guarantee a stable operation in a burst mode controlled system a Vaux slope compensation circuit is integrated in Greeny. The Greeny system delivers a constant voltage to the secondary load until a burst duty cycle of 40%.

DATA TRANSFER

The TEA1501 has a data transfer function which makes communication from the isolated secondary side to the non-isolated primary side of the transformer possible, without using an opto-coupler. This communication function is activated by increasing the secondary load. With this data transfer function a main power supply can be switched on and off by the Greeny system.

The power delivered to the secondary and auxiliary winding is proportional to the number of primary current pulses per burst period, provided that the converter operates in discontinuous conduction mode. During each burst period the number of primary current pulses is counted. A threshold (N_{data}) of 56 pulses is integrated. The clamp level on the OOD pin is set to data-on level from data-off level in case the N_{data} threshold is passed. This data-on clamp level can be sensed by the on/off input of a main supply control IC of the GreenChip™ family. The data-on clamp level is maintained until a burst appears with a number of pulses below the N_{data} threshold.

Waveforms of Greeny in the Off mode, Startup mode and Operation mode

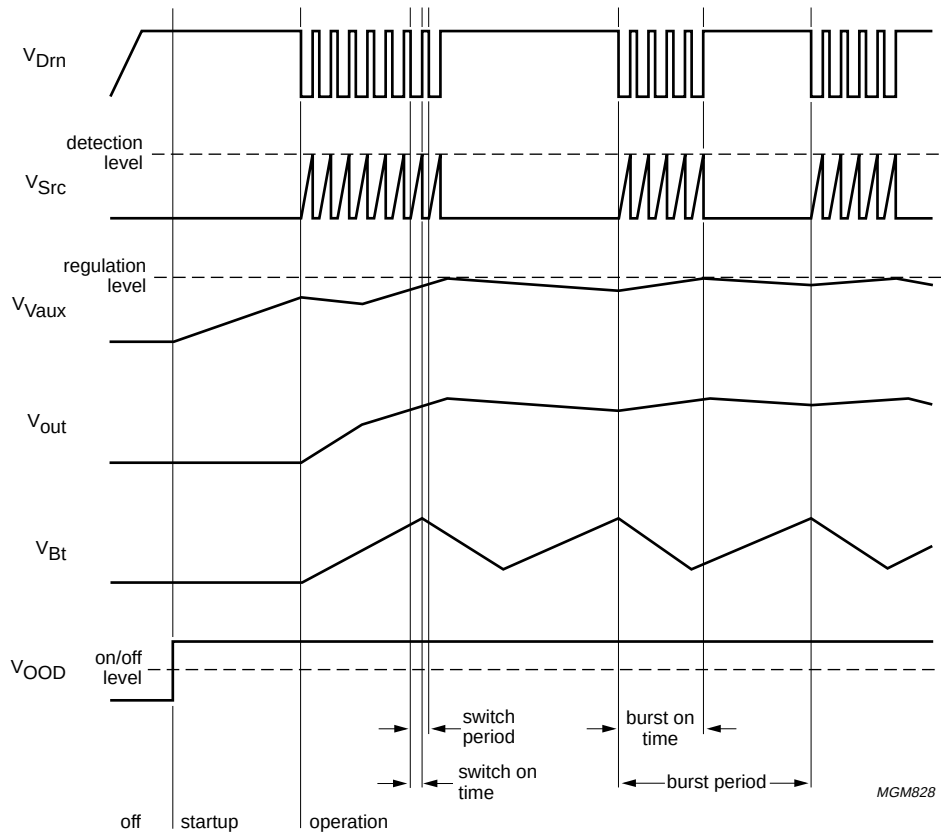


Fig.4 Waveforms of Greeny in the Off mode, Startup mode and Operation mode.

CIRCUIT BLOCK DESCRIPTION

On/Off/Data section

The On/Off/Data block contains a comparator for the on/off level and is active if the drain voltage is above 50 V (DC). The typical current consumption in Off mode is 40 μA. The data signal changes the clamp level on the OOD pin to indicate data transfer: low clamp level for data-off and high clamp level for data-on.

Vaux management

The Vaux management block is active when Greeny is in the On mode. This Vaux management block senses the Vaux voltage and determines the state of Greeny: startup or normal operation. During startup the following circuits are active: On/Off/Data section, Reference block (partial), Vaux management, Temperature protection and the Startup current source.

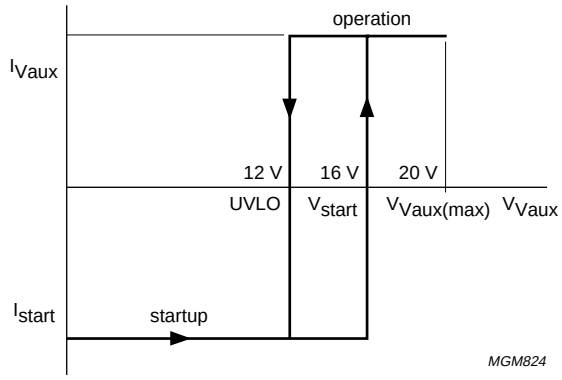


Fig.5 I_{Vaux} versus V_{Vaux}.

Startup current source

The startup sequence is carried out using an accurate startup current source. The startup current flows from the Drn pin to the Vaux pin via the startup current source and charges the Vaux capacitor. When Vaux reaches the startup threshold the startup current is switched off and the flyback converter starts operating and the output voltage rises. The Vaux capacitor must be capable of supplying the entire supply current ($I_{Vaux(LOW)}$) until the output voltage is in regulation. From that moment the Vaux capacitor is charged by the flyback converter via the auxiliary winding.

Reference block

The reference block contains a bandgap circuit which determines all the accurate and temperature independent reference voltages and currents. It defines the voltage detection level for the primary current comparator and it defines the voltage at the Ref pin. The value of the reference resistor determines the burst frequency, the switching frequency and the leading edge blanking time.

Temperature protection

The temperature protection circuit senses the chip temperature using a proportional to absolute temperature voltage (V_{ptat}) generated in the reference block. If the chip temperature exceeds 140 °C the power switch and the startup current source are disabled. When the chip cools down below 100 °C, the startup circuit is enabled again.

Switch oscillator

The switch oscillator determines the switching frequency and the maximum on-time of the power switch. The maximum on-time is set at 66% of the switching period. The switching frequency is determined by the reference resistor at the Ref pin and an internal capacitor. The switching frequency can be adjusted in a range from 20 to 50 kHz, thus above the audible spectrum.

Burst oscillator

The burst oscillator generates a triangular wave signal for determination of the burst frequency. The burst frequency is determined accurately and temperature independent by the externally connected reference resistor R_{Ref} and burst capacitor C_{Bt}.

Gate driver

The gate driver switches the power switch. The power switch is turned on at the beginning of every oscillator cycle and is turned off by the primary current comparator or by the maximum on-time. The power switch is also prevented from turning on if the Vaux voltage has reached its regulation level or in case of active over temperature protection or in case of active under voltage lockout protection.

Power switch

The power switch is an integrated high voltage LDMOST with a R_{dson} of 40 Ω, a maximum peak drain voltage of 650 V, a maximum continuous drain voltage of 500 V and a maximum drain current of 0.25 A.

Primary current comparator

The primary current comparator senses the voltage across the external sense resistor R_{Src} which reflects the primary current. The detection level of the comparator is 0.5 V. The power switch is switched off quickly when the source voltage exceeds this detection level. The comparator has a typical propagation delay of 80 ns. If the dV/dt of the drain voltage has to be limited for EMI reasons, a capacitor can be connected between the Drn and Src pins of Greeny. The discharge current of this EMI capacitor does not flow through the sense resistor R_{Src} and does not activate the comparator.

Leading edge blanking

To prevent the power switch from switching off due to the discharge current of the capacitance on the Drn pin a Leading Edge Blanking (LEB) circuit has been implemented. The leading edge blanking time is defined as the maximum duration time needed to discharge the capacitance at the drain of the power switch. The leading edge blanking time is determined by the reference resistor to obtain an accurate and temperature independent time. The LEB time tracks with the period time of the switch oscillator.

Modulator

The modulator determines the regulation level of the Vaux voltage. For a burst duty cycle from 0 to 40% the Vaux voltage is regulated to 20 V. For stable operation in burst mode a decrease in regulation voltage is integrated for a burst duty cycle above 40%. At 100% burst duty cycle the regulation voltage is 17.5 V.

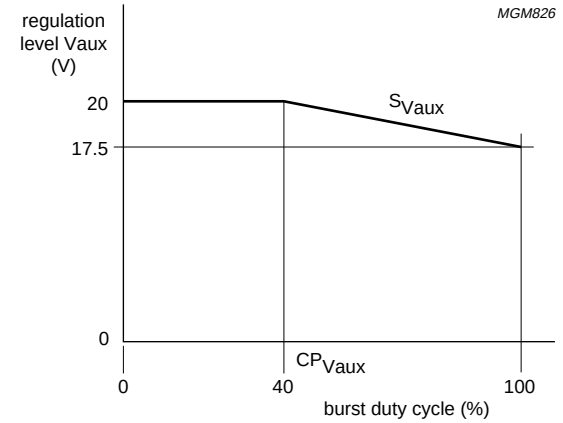


Fig.6 Regulation level V_{Vaux} versus burst duty cycle.

Counter

The power delivered to the load (auxiliary and secondary) is a function of the number of energy pulses per burst, according to the following formula:

$$P_{load} = \eta \times \frac{1}{2} \times L_p \times I_{prim}^{2} \times f_{burst} \times N$$

Where η is the efficiency, L_p is the primary inductance, I_{prim} is the primary peak current, f_{burst} is the burst frequency and N is the number of pulses in one burst period.

The counter counts the number of pulses in each burst period and detects if the N_{data} threshold is passed. The counter state is used for the data transfer function and for the supply current tracking.

Supply current tracking

For obtaining good load regulation, especially with low cost transformers, a tracking circuit is included. The tracking circuit makes the supply current of Greeny a function of the secondary load. This makes the voltage drop across the series resistance of the auxiliary winding proportional to the voltage drop across the series resistance of the secondary winding. Therefore, the secondary output voltage tracks with the Vaux regulation voltage.

The tracking starts at a counter state of 28. For a counter state from 28 up to 112 (typical values) the supply current of Greeny rises linearly with the counter state according to the following formula (see Fig.7).

$$I_{Vaux} = k_{tracking} \times N$$

For counter states of 112 and higher the supply current remains on its maximum value.

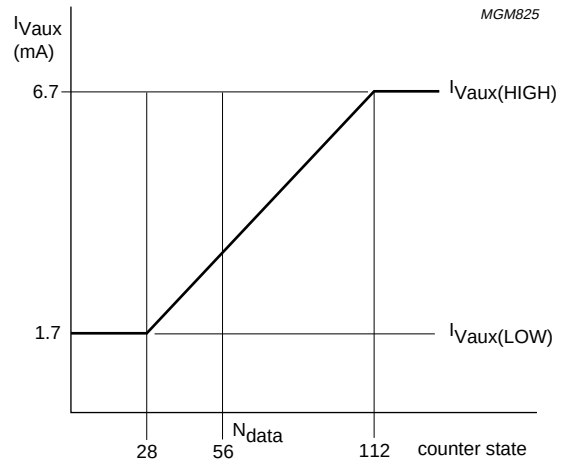


Fig.7 I_{Vaux} versus counter state.

DESIGN EQUATIONS

Primary peak current

The primary peak current is determined by the sense resistor R_{Src} and may be calculated as shown below:

$$R_{Src} = \frac{V_{detect}}{I_{prim}}$$

MINIMUM VALUE OF R_{Src}

The maximum drain current is 0.25 A, this results in a minimum value for resistor R_{Src} of 2.0 Ω.

Switch oscillator

The maximum output power of the converter is a function of the switching frequency, provided that the converter operates in discontinuous conduction mode.

$$P_{out(max)} = \eta \times \frac{1}{2} \times L_p \times I_{prim}^2 \times f_{switch}$$

Where η is the efficiency, Lp is the primary inductance, I_{prim} is the primary peak current and f_{switch} is the switching frequency.

The switching frequency can be adjusted between 20 and 50 kHz by the reference resistor R_{Ref}:

$$f_{switch} = \frac{1}{k_{switch} \times R_{Ref}}$$

RANGE OF R_{Ref} VALUES

The minimum value for resistor R_{Ref} is 24 kΩ, the maximum value is 62 kΩ.

Leading edge blanking

The leading edge blanking time is determined by the reference resistor R_{Ref} as shown below:

$$t_{LEB} = t_{constant} + (k_{LEB} \times R_{Ref})$$

The leading edge blanking time consists of a constant time and a time which tracks with the period time of the switch oscillator

Burst oscillator

The power threshold for data transfer is determined by the burst frequency, according to the following formula:

$$P_{data} = \eta \times \frac{1}{2} \times L_p \times I_{prim}^2 \times f_{burst} \times N_{data}$$

The power ratio between P_{data} and $P_{out(max)}$ is therefore:

$$\frac{P_{data}}{P_{out(max)}} = \frac{f_{burst} \times N_{data}}{f_{switch}}$$

The desired $P_{data}/P_{out(max)}$ ratio determines the burst frequency. For example, when the desired $P_{data}/P_{out(max)}$ ratio is 0.5 then the burst frequency has to be 450 Hz at 50 kHz switching frequency. The burst frequency can be adjusted by the reference resistor R_{Ref} and the burst capacitor C_{Bt} as shown below:

$$f_{burst} = \frac{1}{k_{burst} \times R_{Ref} \times C_{Bt}}$$

MINIMUM VALUE OF C_{Bt}

The minimum value for capacitor C_{Bt} is 3.3 nF.

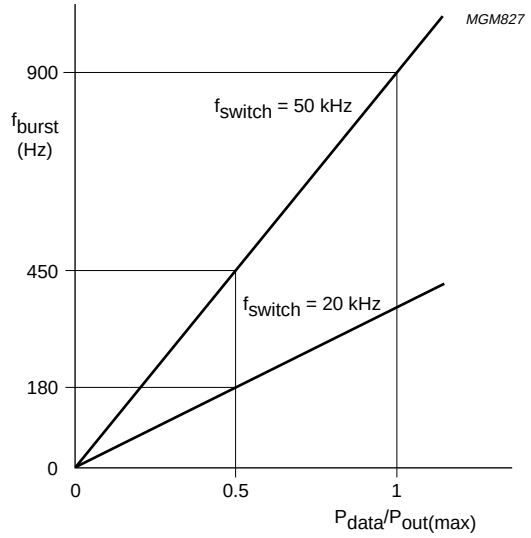


Fig.8 f_{burst} versus $P_{data}/P_{out(max)}$.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134). All voltages are referred to ground. Positive currents flow into the IC. All pins not mentioned in the voltage list are not allowed to be voltage driven.

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
Voltages				
V_{Drn}	commutation voltage peak: $V_{in} + V_{zener}$	–0.4	+650	V
V_{Src}		–0.4	+12	V
V_{Vaux}		–0.4	+24	V
V_{Bt}		–0.4	+5	V
Currents				
I_{Drn}		0	0.25	A
I_{Src}		0	0.25	A
I_{OOD}		–1	+ 5	mA
I_{Ref}		–1	+0	mA
I_{Bt}		–1	+0.05	mA
Power and temperature				
P_{tot}	total power dissipation, T_{amb} < 70 °C	–	0.7	W
T_j	junction temperature	–10	+140	°C
T_{stg}	storage temperature	–40	+150	°C
T_{amb}	operating ambient temperature	–10	+70	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	96	°C/W

CHARACTERISTICS

Conditions unless otherwise specified: –10 °C <T_j < 80 °C, R_{Ref} = 24 kΩ – 0.1%; 12 V < V_{Vaux} <20 V. All voltages are referred to ground. Positive currents flow into the IC.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
On Off Data section						
$V_{on/off}$	on/off level Greeny		0.4	0.7	0.9	V
$V_{data(off)}$	data off level	20 µA < I_{OOD} < 100 µA	0.9	1.3	1.6	V
$V_{data(off)}$	data off level	I_{OOD} = 2.5 mA	1.4	1.7	2.0	V
$V_{data(on)}$	data on level	20 µA < I_{OOD} < 100 µA	3.5	4.0	4.5	V
Vaux management						
V_{start}	start voltage		15	16	17	V
UVLO	Under Voltage Lockout		11.3	12	12.7	V
Startup current source						
I_{start}	startup current, Vaux pin	V_{Vaux} = 0 V, V_{OOD} > 0.9 V	–3.0	–2.2	–1.5	mA
I_{start}	startup current, Vaux pin	V_{Vaux} = 8 V, V_{OOD} > 0.9 V	–2.4	–1.8	–1.2	mA
I_{start}	startup current, Vaux pin	V_{Vaux} = 15 V, V_{OOD} > 0.9 V	–1.9	–1.3	–0.8	mA
$I_{Drn(on)}$	drain current during startup	V_{Vaux} = 0 V, V_{OOD} > 0.9 V	1.8	2.6	3.4	mA
$I_{Drn(off)}$	drain current in Off mode	V_{OOD} < 0.4 V, V_{Drn} = 300 V	–	40	100	µA
Reference block						
V_{Ref}	reference voltage		1.18	1.23	1.28	V
Temperature protection						
T_{prot}	thermal shutdown		130	140	150	°C
T_{hys}	thermal hysteresis		35	40	45	°C
Switch oscillator						
k_{switch}	switch oscillation constant		0.67	0.82	1.00	µs/kΩ
$\delta_{cy(max)}$	maximum switch duty cycle		60	66	72	%
Burst oscillator						
k_{burst}	burst oscillation factor		7.0	7.5	8.1	
Counter						
N_{data}	number of current pulses for data transfer		50	56	62	
Power switch						
V_{BD}	breakdown voltage	$I_{Drn(off)}$ + 100 µA	650	–	–	V
R_{dson}	on resistance	T_j = 25 °C, I_{Drn} = 80 mA	25	40	55	Ω
t_f	fall time	V_{Drn} = 300 V, Rdr = 2 kΩ	–	50	–	ns
t_r	rise time	V_{Drn} = 300 V, Rdr = 2 kΩ	–	100	–	ns

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Comparator						
V_{detect}	primary peak detection level		0.47	0.50	0.53	V
t_{PD}	propagation delay	dVsource/dt = 0.5 V/µs	–	80	–	ns
Leading edge blanking						
$t_{constant}$	constant part of the LEB time, independent of Rref		100	250	400	ns
k_{LEB}	LEB time constant		4	5	6	ns/kΩ
Modulator						
$V_{Vaux(max)}$	maximum V_{Vaux} non-compensation	$\delta_{burst} < CP_{Vaux}$	19	20	21	V
CP_{Vaux}	compensation point		37	40	43	%
S_{Vaux}	slope of $V_{Vaux(max)}$, $\Delta V_{Vaux(max)}/(100\% - CP_{Vaux})$	$\delta_{burst} < CP_{Vaux}$	34	42	50	mV/%
V_{offset}	offset voltage on $V_{Vaux(max)}$ at compensation point		–	–0.1	–	V
Supply current tracking						
$I_{Vaux(LOW)}$	low supply current non-tracking	$N < \frac{1}{2}N_{data}$	1.2	1.7	2.5	mA
$k_{tracking}$	tracking constant		48	60	72	µA
$I_{Vaux(HIGH)}$	high supply current non-tracking	$N > 2N_{data}$	5.4	6.7	8.0	mA

QUALITY SPECIFICATION

Quality according to SNW/FQ-611 part E.

The ESD voltage according to the Human Body Model is limited to 1200 V for the Drn pin.

LOW POWER STANDBY APPLICATION

Greeny can operate as a stand alone low power supply or as a standby power supply incorporated in a main SMPS.

Together with a GreenChip™ TEA1504 a power supply with ultra low standby power can be built where Greeny supplies the microprocessor with the power on/off indicator and the GreenChip™ controls the main power supply during normal operation.

Operation modes

The power supply with a Greeny TEA1501 and a GreenChip™ TEA1504 can be in three different modes, according to the state of switches S1 and S2 (see Fig.9).

Table 1 Operation modes of power supply

S1	S2	OPERATION MODE
Open	Open or Closed	Greeny is in Off mode, GreenChip™ is in Off mode, Power supply is in Off mode.
Closed	Open	Greeny is On mode, GreenChip™ is in Off mode, Power supply is in Standby mode.
Closed	Closed	Greeny is in On mode, GreenChip™ is in On mode, Power supply is in Normal operation mode.

Power supply in Off mode

The power supply can be switched on and off by means of the functional switch S1. This functional switch replaces the generally used high voltage mains switch. The power supply is in Off mode if the switch S1 is open.

If the switch S1 is closed the voltage applied on the OOD pin of Greeny is above the on/off level (0.7 V) and Greeny starts up, the power supply enters the Standby mode or the Normal operation mode.

When the switch S1 is opened the voltages on the OOD pin of Greeny and the OOB pin of the GreenChip™ are 0 V. The power supply and the power on/off indicator (LED) are switched off immediately and the power supply is in the Off mode again.

Power supply in Standby mode

When switch S1 is closed Greeny is in the On mode and supplies the microprocessor and the power on/off indicator. The microprocessor controls the state of switch S2. The power supply is in the Standby mode when switch S2 is open.

The output power of Greeny is determined by the microprocessor and is below the P_{data} level when switch S2 is open. The clamp level on the OOD pin of Greeny is the data-off level with a typical value of 1.3 V which is below the on/off level of the GreenChip™ which has a typical value of 2.5 V. The GreenChip™ remains in Off mode.

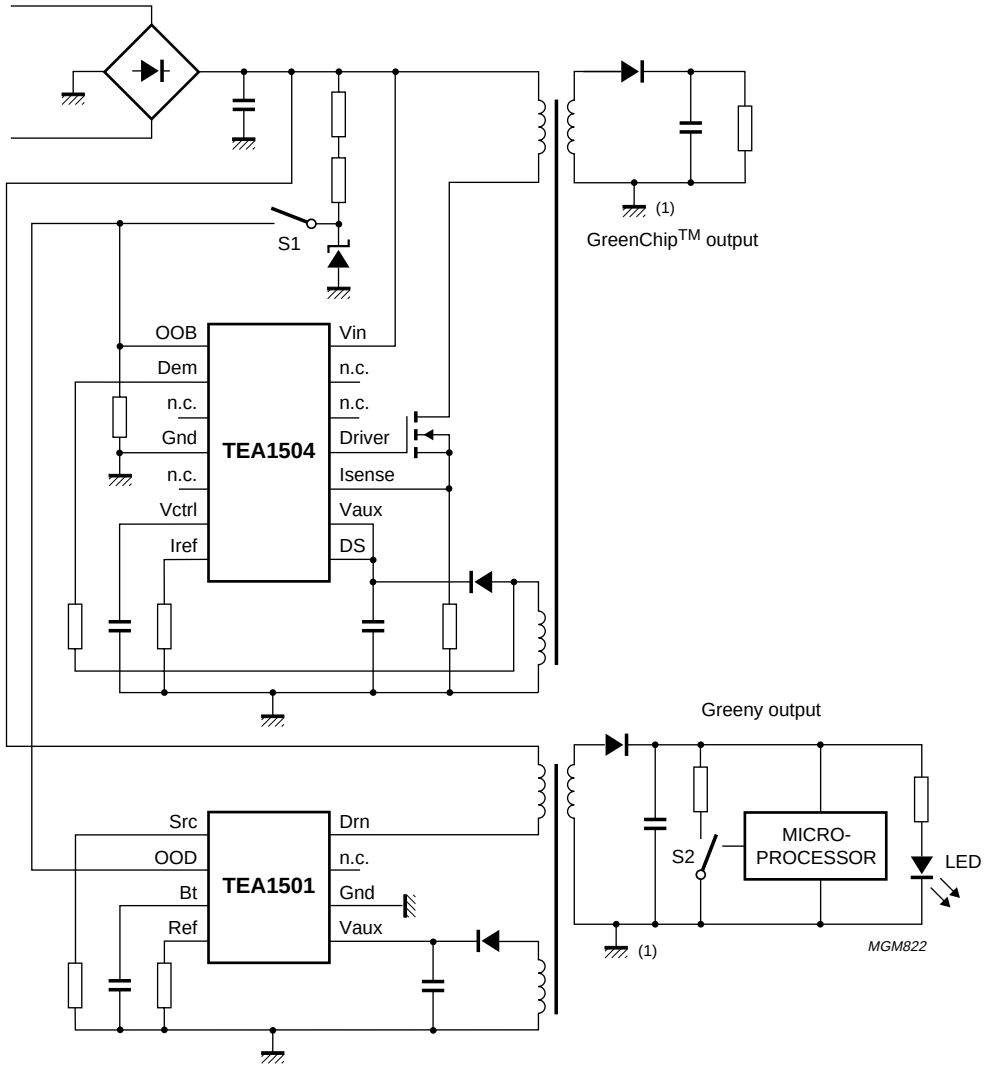
Power supply in Normal operation mode

The power supply changes its operation mode from Standby to Normal operation by closing the switch S2. The switch S2 is placed at the isolated secondary side of the Greeny and controls, via the data transfer function of Greeny, the operation mode of the power supply.

When the microprocessor closes switch S2 the output power of Greeny is increased. The output power exceeds the P_{data} level and the clamp level on the OOD pin of Greeny is set to data-on level with a value of 4 V. The voltage on the OOB pin of the GreenChip™ is above its on/off level of 2.5 V and the GreenChip™ starts up.

The power supply enters Normal operation mode, Greeny supplies the microprocessor and the GreenChip™ supplies the main load.

APPLICATION DIAGRAM WITH GREENY TEA1501 AND GREENCHIP™ TEA1504

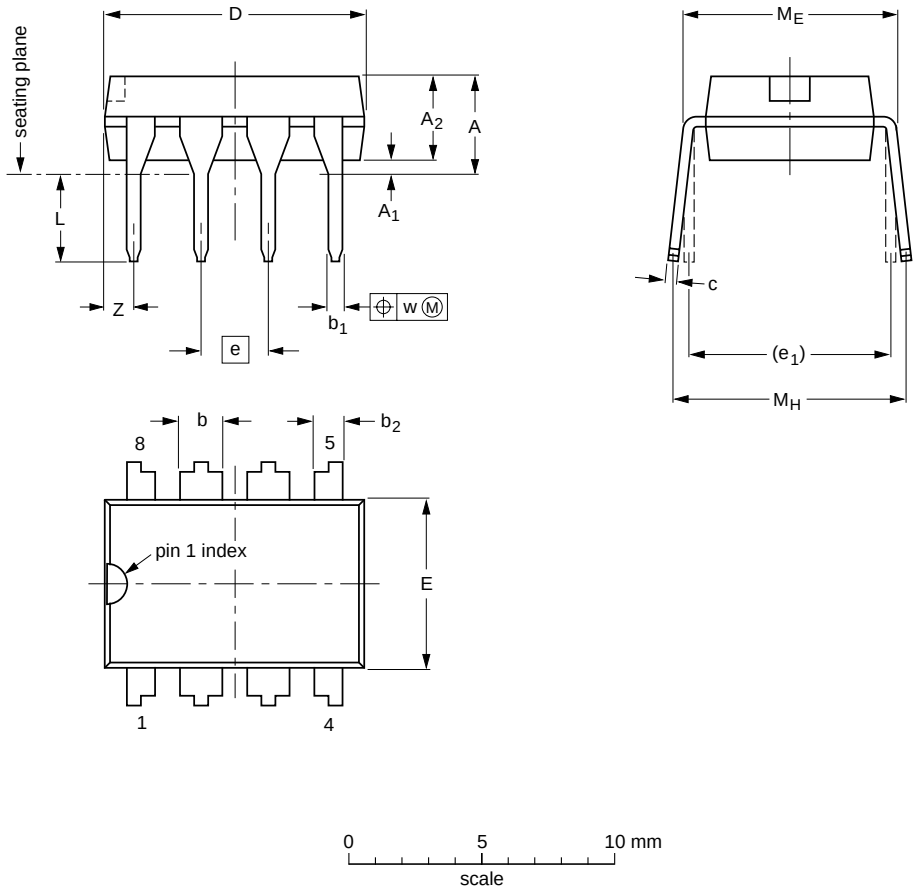


(1) Secondary earthing points are isolated from their primary earthing points.

Fig.9 Application diagram with greeny TEA1501 and GreenChip™ TEA1504.

PACKAGE OUTLINE

DIP8: plastic dual in-line package; 8 leads (300 mil) **SOT97-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	b_2	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.14	0.53 0.38	1.07 0.89	0.36 0.23	9.8 9.2	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	1.15
inches	0.17	0.020	0.13	0.068 0.045	0.021 0.015	0.042 0.035	0.014 0.009	0.39 0.36	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.045

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
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SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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NOTES

Philips Semiconductors – a worldwide company

Argentina: see South America

Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113,
Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

Austria: Computerstr. 6, A-1101 WIEN, P.O. Box 213, Tel. +43 160 1010,
Fax. +43 160 101 1210

Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,
220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

Belgium: see The Netherlands

Brazil: see South America

Bulgaria: Philips Bulgaria Ltd., Energoproject, 15th floor,
51 James Bourchier Blvd., 1407 SOFIA,
Tel. +359 2 689 211, Fax. +359 2 689 102

Canada: PHILIPS SEMICONDUCTORS/COMPONENTS,
Tel. +1 800 234 7381

China/Hong Kong: 501 Hong Kong Industrial Technology Centre,
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,
Tel. +852 2319 7888, Fax. +852 2319 7700

Colombia: see South America

Czech Republic: see Austria

Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,
Tel. +45 32 88 2636, Fax. +45 31 57 0044

Finland: Sinikalliontie 3, FIN-02630 ESPOO,
Tel. +358 9 615800, Fax. +358 9 61580920

France: 51 Rue Carnot, BP317, 92156 SURESNES Cedex,
Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG,
Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

Greece: No. 15, 25th March Street, GR 17778 TAVROS/ATHENS,
Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

Hungary: see Austria

India: Philips INDIA Ltd, Band Box Building, 2nd floor,
254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025,
Tel. +91 22 493 8541, Fax. +91 22 493 0966

Indonesia: PT Philips Development Corporation, Semiconductors Division,
Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510,
Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

Ireland: Newstead, Clonskeagh, DUBLIN 14,
Tel. +353 1 7640 000, Fax. +353 1 7640 200

Israel: RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

Italy: PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku,
TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,
Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,
Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,
Tel. +9-5 800 234 7381

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,
Tel. +31 40 27 82785, Fax. +31 40 27 88399

New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,
Tel. +64 9 849 4160, Fax. +64 9 849 7811

Norway: Box 1, Manglerud 0612, OSLO,
Tel. +47 22 74 8000, Fax. +47 22 74 8341

Pakistan: see Singapore

Philippines: Philips Semiconductors Philippines Inc.,
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Ul. Lukiska 10, PL 04-123 WARSZAWA,
Tel. +48 22 612 2831, Fax. +48 22 612 2327

Portugal: see Spain

Romania: see Italy

Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,
Tel. +7 095 755 6918, Fax. +7 095 755 6919

Singapore: Lorong 1, Toa Payoh, SINGAPORE 319762,
Tel. +65 350 2538, Fax. +65 251 6500

Slovakia: see Austria

Slovenia: see Italy

South Africa: S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,
2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000,
Tel. +27 11 470 5911, Fax. +27 11 470 5494

South America: Al. Vicente Pinzon, 173, 6th floor,
04547-130 SÃO PAULO, SP, Brazil,
Tel. +55 11 821 2333, Fax. +55 11 821 2382

Spain: Balmes 22, 08007 BARCELONA,
Tel. +34 93 301 6312, Fax. +34 93 301 4107

Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM,
Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

Switzerland: Allmendstrasse 140, CH-8027 ZÜRICH,
Tel. +41 1 488 2741 Fax. +41 1 488 3263

Taiwan: Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,
TAIPEI, Taiwan Tel. +886 2 2134 2865, Fax. +886 2 2134 2874

Thailand: PHILIPS ELECTRONICS (THAILAND) Ltd.,
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,
Tel. +66 2 745 4090, Fax. +66 2 398 0793

Turkey: Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,
Tel. +90 212 279 2770, Fax. +90 212 282 6707

Ukraine: PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes,
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

United States: 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,
Tel. +1 800 234 7381

Uruguay: see South America

Vietnam: see Singapore

Yugoslavia: PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,
Tel. +381 11 625 344, Fax.+381 11 635 777

For all other countries apply to: Philips Semiconductors,
International Marketing & Sales Communications, Building BE-p, P.O. Box 218,
5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

Internet: http://www.semiconductors.philips.com

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